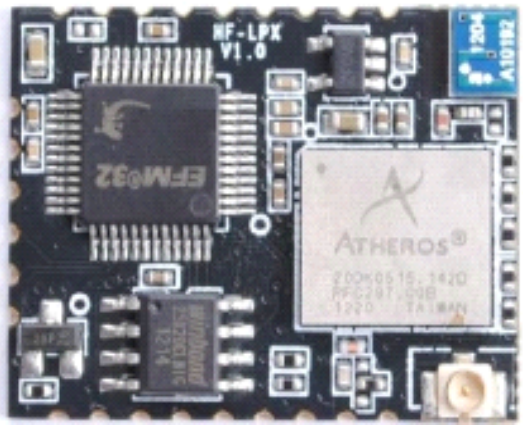
Low Power WiFi Module User Manual

V 1.0



Overview of Characteristic

Support IEEE802.11b/g/n Wireless Standards

Fully Self-Contained Serial-to-Wireless Functionality

Ultra-Low-Power for Battery Applications with Excellent Power Save Scheme

Support UART/SPI/GPIO Data Communication Interface

Support Work As STA/Ad-Hoc Mode

Support SoftAP Mode with One STA Connected

Support Internal/External Antenna Option

Support AT+ Instruction Set for Configuration

Support UART Free/Auto Frame

Single +3.3V Power Supply

Smallest Size: 20 x 25mm

FCC/CE Certificate

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HISTORY

Ed. V0.1 Created on 7-26-2012.

Ed. V0.3 Add AT+ instruction set introduction.

Ed. V1.0 Released 9-17-2012.

1. PRODUCT OVERVIEW

1.1. General Description

The Low Power WiFi Module is a fully self-contained small form-factor, single stream, 802.11b/g/n Wi-Fi module, which provide a wireless interface to any equipment with a serial or SPI interface for data transfer.Low Power WiFi Module integrate MAC, baseband processor, RF transceiver with power amplifier in hardware and all Wi-Fi protocol and configuration functionality and networking stack, in embedded firmware to make a fully self-contained 802.11b/g/n Wi-Fi solution for a variety of applications.

The Low Power WiFi Module is targeted at applications that send infrequent data packets over the network. Typically, these 802.11 applications will place a higher priority on system cost, power consumption, ease of use, and fast wake-up times as compared to high throughput.

The Low Power WiFi Module employs the world's lowest power consumption embedded architecture. It has been optimized for all kinds of client applications in the home automation, smart grid, handheld device, personal medical application and industrial control that have lower data rates, and transmit or receive data on an infrequent basis. The module features standby current consumption of less than 1uA while still monitoring peripherals.

The Low Power WiFi Module integrates all Wi-Fi functionality into a low-profile, 20 mm x 25 mm SMT module package that can be easily mounted on main PCB with application specific circuits. Also, module provides built-in antenna, external antenna connector and an interface port to the carrier board.

1.1.1 Device Features

Single stream Wi-Fi @ 2.4 GHz with support for WEP security mode as well as WPA/WPA2
Fully self-contained serial-to-wireless functionality.
Ultra-low-power operation with all kinds of power-save modes.
Includes all the protocol and configuration functions for Wi-Fi connectivity.
WPS support
SoftAP mode support
Host interface through Serial Interface and SPI.
Wide range of connector ports including SPI, UART ports and ADC/DAC, PWM, GPIO ports.
Integrated chip antenna, antenna connector, and RF line output options.
Optional support for built-in web server.
Compact surface mount module 20x25mm.
Full IPv4 and IPv6 stack.
Low power RTOS and drivers.
FCC Certified.
RoHS and CE compliant.
Single supply – 3.3V operation.

1.1.2 Device Paremeters

Table 1 Low Power WiFi Module Technical Specifications

Class	Item	Parameters
Wireless Parameters	Certification	FCC/CE
	Wireless standard	802.11 b/g/n
	Frequency range	2.412GHz-2.484GHz
	Transmit Power	802.11b: +18.5 dBm (@1Mbps)
		802.11g: +16.5 dBm (@54Mbps)
		802.11n: +10.5 dBm (@HT20, MCS7)
	Receiver Sensitivity	802.11b: -87 dBm (@11Mbps ,CCK)
		802.11g: -74dBm (@54Mbps, OFDM)
		802.11n: -71dBm (@HT20, MCS7)
	Antenna Option	External:I-PEX Connector
		Internal:On-board chip antenna
		RF Line: link to main board through pad
Hardware Parameters	Data Interface	UART
		GPIOs
		Others: SPI, ADC/DAC, PWM…
	Operating Voltage	3.1~3.6V
	Operating Current	Peak [Continuous TX]: 200mA Normal [WiFi ON/OFF, DTIM=100ms]: Average. 5mA, Peak: 200mA Deep Sleep: [WiFi OFF]: <~2uA Standby [WiFi Shutdown]: <1uA Refer “Power Save Scheme” Chapter
	Operating Temperature	-30℃- 85℃
	Storage Temperature	-40℃- 125℃
	Dimensions and Size	20×25×2mm
Software Parameters	Network Type	STA /Ad-Hoc/SoftAP mode
	Security Mechanisms	WEP/WPA-PSK/WPA2-PSK/WPS
	Encryption	WEP64/WEP128/TKIP/AES
	Transition Time	Deep Sleep to Normal: ~115ms Standby to Normal: 195ms (Same AP) Standby to Normal: 500ms (rescan)
	Serial command	AT+instruction set
	Network Protocol	IPv4, IPv6,TCP/UDP/FTP/HTTP
	User Configuration	AT+instruction set. Android/ iOS

1.1.3 Key Application

Remote equipment monitoring
Asset tracking and telemetry
Security
Industrial sensors and controls
Home automation
Medical devices

1.2. Hardware Introduction

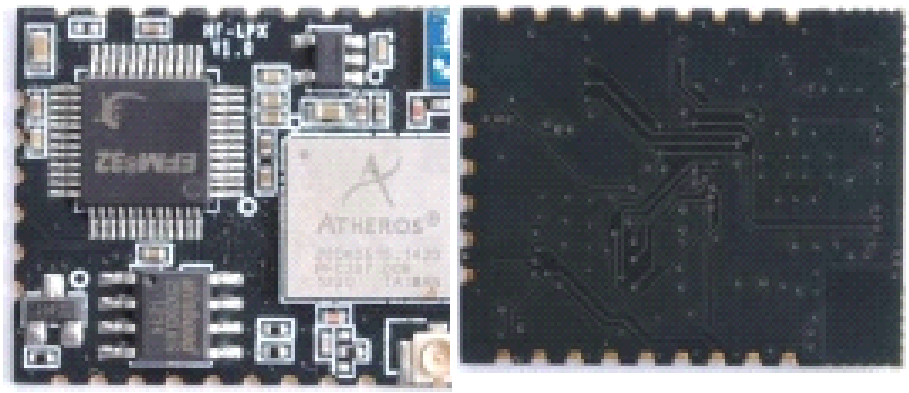


Figure 1. Low Power WiFi Module Demo

1.2.1 Pins Definition

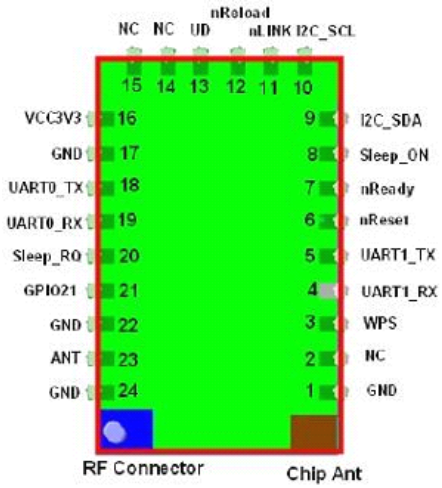


Figure 2. Low Power WiFi Module Pins Map

Table2 Low Power WiFi Module Pins Definition

Pin	Description	Name	Direction	Note
1,17,22,24	Ground	GND	Power	
2	No Connect	NC	O	Reserved for RF testing.
3	WPS Input (GPIO3)	WPS	I, IPU	WiFi Protected Setup input.
4	UART1 Data Receive	UART1_RX	I	Low Energy UART (Optional) Default as GPIO functional pin
5	UART1 Data Transmit	UART1_TX	O	
6	Module Reset signal	nReset	I, IPU	"Low" effective reset input.
7	Module Ready Indicator (GPIO7)	nReady	O, IPU	"0" - Finish boot up process; "1" - Module boot up not finish.

8	Pin Sleep Indicator (GPIO8)	Sleep_ON	O, IPD	“0”- Module in sleep status; “1”- Module in awake status; No connect if sleep not used.
9	I2C Serial Data (GPIO9)	I2C_SDA	I/O, IPU	I2C Serial Data input/output.
10	I2C Serial Clock (GPIO10)	I2C_SCL	O, IPU	I2C Serial Clock Line output.
11	WiFi Status Indication (GPIO11)	nLINK	O, IPU	“0”- WIFI connected “1”- No WIFI connection
12	Restore Configuration (GPIO12)	nReload	I, IPU	Module will restore factory default configuration after set this pin “0” more than 3s, then set “1”. No connect if not used.
13	Firmware Update Enable	UD	I, IPD	“0”- Module normal operation. “1”- Module ready for firmware update through UART0 after reset operation.
14,15	No Connect	NC	I/O	Reserved for MFG testing.
16	VCC	VCC3V3	Power	3.3V@ 250mA
18	UART0 Data Transmit	UART0_TX	O	General Data Communication Interface
19	UART0 Data Receive	UART0_RX	I	
20	Pin Sleep Control (GPIO20)	Sleep_RQ	I, IPD	“0”- Drive module to sleep; “1”- Wake up the module; No connect if sleep not used.
21	GPIO functional pin	GPIO21	I/O	GPIO, PWM functional pin
23	2.4GHz Antenna line out	Ant_2.4G	O	Must 50ohm line

1.2.2. Electrical Characteristics

Absolute Maximum Ratings:

Power Supply & Power Consumption:

Input leakage current				+/-25	nA
I/O pull up resistor			40		Kohm
I/O pull down resistor			40		Kohm
Analog input range		0		3	V
Analog output range		0		3	V

1.2.3. Mechanical Size

Low Power WiFi Modules physical size （Unit: mm） as follows:

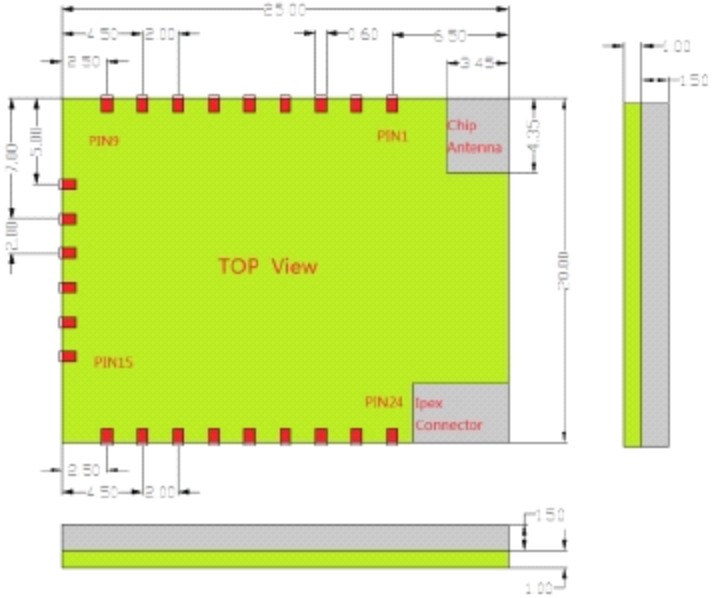


Figure 3. Low Power WiFi Module Mechanical Dimension

1.2.4. External Antenna

Low Power WiFi Module supports internal antenna and external antenna option for user dedicated application.

If user select external antenna, Low Power WiFi Modules must be connected to the 2.4G antenna according to IEEE 802.11b/g/n standards.

The antenna parameters required as follows:

Table 3 Low Power WiFi Module External Antenna Parameters

Item	Parameters
Frequency range	2.4~2.5GHz
Impedance	50 Ohm
VSWR	2 (Max)
Return Loss	-10dB (Max)
Connector Type	I-PEX or populate directly

1.2.5. Evaluation Kit

Manufacturer provides the evaluation kit to promote user to familiar the product and develop the detailed application. The evaluation kit shown as below, user can connect to Low Power WiFi Module

with the RS-232 UART port or Wireless port to configure the parameters, manage the module or do the some functional tests.

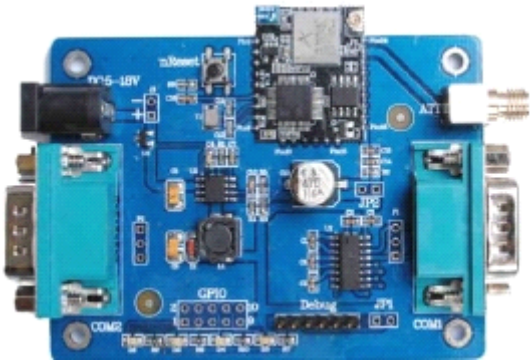


Figure 4. Low Power WiFi Module Evaluation Kit

The external interface description for evaluation kit as follows:

Table 4 Low Power WiFi Module Evaluation Kit Interface Description

Function	Name	Description
External Interface	COM1	Main data/command RS-232 interface
	P1	3-Pin UART0 RS-232 interface.
	COM2	Low Power data RS-232 interface (Optional)
	P2	3-Pin UART1 RS-232 interface.
	DC5-18V	DC jack for power in, 5~15V input
	ATT	2.4GHz SMA connector for external antenna.
	JP2	Low Power WiFi Module power current test interface connector
	GPIO	Low Power WiFi Module GPIO function extend interface connector
	Debug	Reserved, leave open
	JP1	Firmware Update Jumper. Leave open for normal operation. Add Jumper for updated Low Power WiFi Module firmware download from COM1.
LED	Power	3.3V Power Indicator
	nLink	nLink -WiFi LINK Indicator
	nReady	nReady – Module Bootup Ready Indicator
	Sleep_ON	Sleep_ON-Module asleep or awake Indicator
	I/O21	GPIO21 functional Indicator, PWM
Button	nReset	Used to reset the module.
	nReload	Restore factory default configuration after push this pin more than 3s.
	WPS	WPS Button
	Sleep_RQ	Pin Sleep Control button, more than 1s to put module in standby mode.

1.3. Typical Application

1.3.1. Hardware Typical Application

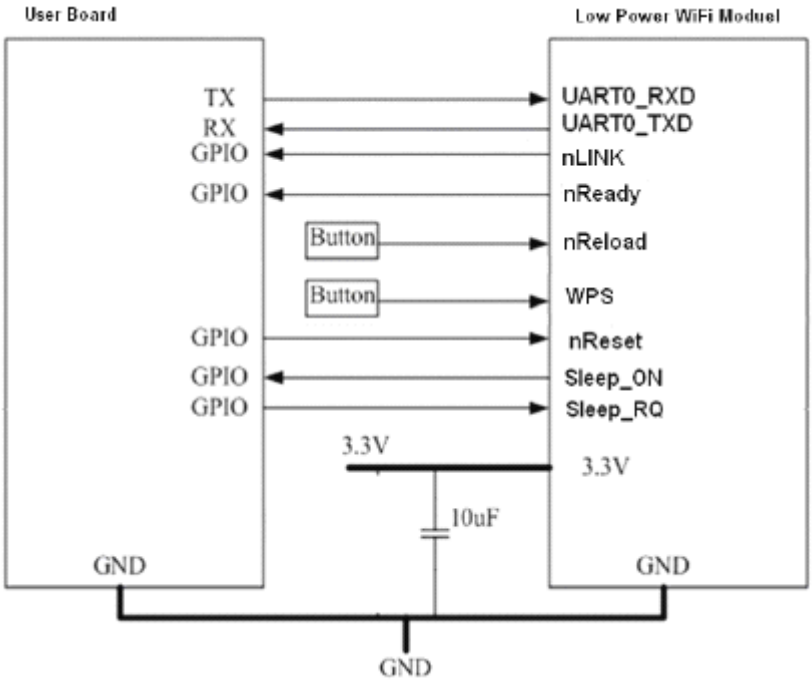


Figure 5. Low Power WiFi Module Hardware Typical Application

Notes:

nReset- Module hardware reset signal. Input. Logics “0” effective.
There is pull-up resister internal and no external pull-up required. When module power up or some issue happened, MCU need assert nRST signal “0” at least 10ms, then set” 1” to keep module fully reset.

nLink- Module WIFI connection status indication. Output.
When module connects to AP (AP associated), this pin will output “0”. This signal used to judge if module already at WiFi connection status. Thers is pull-up resister internal and no external pull-up required. If n Link function not required, can leave this pin open.

nReady- Module boot up ready signal. Output. Logics “0” effective.
The module will output “0” after normal boot up. This signal used to judge if module finish boot up and ready for application or working at normal mode. If nReady function not required, can leave this pin open.

WPS – module auto-negotiation with AP and acquire password and build link
User can de-asser this pin low ”0”, after 500ms, then asser this pin high “1” to enable the auto negotiation.if AP also push its WPS button, then Module and AP will start auto-negotiation and module acquire password and build link. Next time, module will link with same AP without auto-negotiation required. User can use “AT+WSSSID” and “AT+WSKEY” command to query SSID and password.

nReload- Module restore to factory default configuration.Input. Logics “0” effective.
User can de-assert nReload signal “0” more than 3s through button or MCU pin, then release, module will restore to factory default configuration and re-start boot up process. Thers is pull-up resister internal and no external pull-up required. If nReload function not required, can leave this pin open.

Sleep-RQ- Module Pin Sleep Control. Input.
The user should de-assert this pin low “0”, after 1’s assert to high ”1” to put the module to sleep status. Also at the deep sleep/standby mode, user can de-assert this pin low “0”, after 1’s assert to high ”1” to put the module to wake up the module. If user doesn't use pin sleep function, can leave this pin open.

Sleep-ON- Module Pin Sleep Indicator. Output.
This pin is used to indicate that the module is asleep (Module output “0”) or awake (Module output “1”) status. If user doesn't use pin sleep function, can leave this pin open.

Detailed Sleep function describtion, pls refer to 2.9.

UART0_TXD/RXD- UART port data transmit and receive signal.

2. FUNCTIONAL DESCRIPTION

2.1. Wireless Networking

2.1.1. Basic Wireless Network Based On AP (Infrastructure)

Infrastructure: it's also called basic network. It built by AP and many STAs which join in.
The characters of network of this type are that AP is the centre, and all communication between STAs is transmitted through the AP. The figure following shows such type of networking.

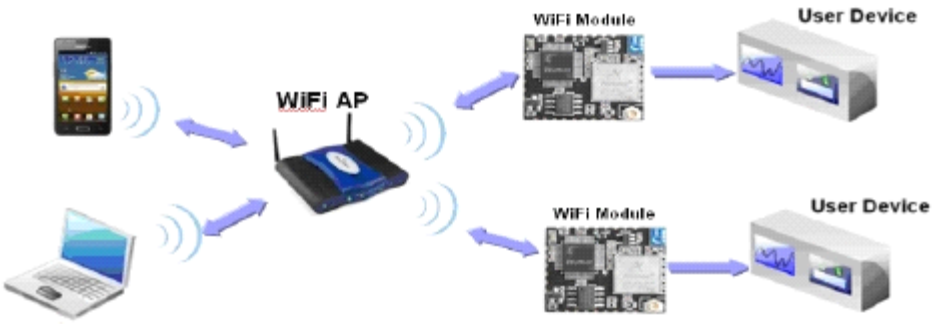


Figure 6. Low Power WiFi Module Basic Wireless Network Structure

2.1.2. Wireless Network Based On Adhoc Network (Adhoc)

Adhoc: It's also called independent basic service set, and it's built by two STAs without AP, this type of network is a loose structure, all the STAs in the network can communicate directly. Note that ad hoc networks are point to point and that there can only be two nodes in the network, a creator and a joiner. Set up the creator first, and then the joiner.

Figure 7. Low Power WiFi Module Adhoc Network Structure

2.2. Work Mode : Transparent Transmission Mode

Low Power WiFi Module support serial interface transparent transmission mode. The benefit of this mode is achieves a plug and play serial data port, and reduces user complexity furthest. In this mode, user should only configure the necessary parameters. After power on, module can automatically connect to the default wireless network and server.

As in this mode, the module's serial port always work in the transparent transmission mode, so users

only need to think of it as a virtual serial cable, and send and receive data as using a simple serial. In other words, the serial cable of users' original serial devices is directly replaced with the module; user devices can be easy for wireless data transmission without any changes.

The transparent transmission mode can fully compatible with user's original software platform and reduce the software development effort for integrate wireless data transmission.

2.3. UART Frame Scheme

2.3.1. UART Free-Frame

Low Power WiFi Module support UART free-frame function. If user select open this function, module will check the intervals between any two bytes when reciving UART data. If this interval time exceeds defined value (50ms default), Low Power WiFi Module will think it as the end of one frame and transfer this free-frame to WiFi port, or Low Power WiFi Module will receive UART data untill 1400 bytes, then transfer 1400 bytes frame to WiFi port.

Low Power WiFi Module's default interval time is 50ms. User can also set this interval to fast (10ms) through AT command. But user have to consider if user MCU can send UART data with 10ms interval ,or the UART data may be divide as fragment.

Through AT command: AT+UARTTE=fash/normal, user can set the interval time: fast (10ms) and normal (50ms).

2.3.2. UART Auto-Frame

Low Power WiFi Module support UART auto-frame function. If user select open this function and setting auto-frame trigger length and auto-frame trigger time parameters, then module will auto framing the data which received from UART port and transmitting to the network as pre-defined data structure.

> **Auto-frame trigger length**: The fixed data length that module used to transmitting to the network.
>
> **Auto-frame trigger time:** After the trigger time, if UART port received data can't reach auto-frame trigger length, then module will transmitting available data to the network and bypass the auto-frame trigger length condition.

Detailed UART auto-frame function can refer to AT+ instruction set "UARTF/UARTFT/UARTFL" introduction.

2.4. Encryption

Encryption is a method of scrambling a message that makes it unreadable to unwanted parties, adding a degree of secure communications. There are different protocols for providing encryption, and the Low Power WiFi Module supports following:

WEP

WPA-PSK/TKIP
WPA-PSK/AES
WPA2-PSK/TKIP
WPA2-PSK/AES

2.5. Advanced WiFi Features

Low Power WiFi Module automatically implements a variety of advanced WiFi features, these WiFi features includes:

WWR, 802.11d
WiFi Protected Setup (WPS) 2.0
Self-managed power state handling
Self-contained beacon processing
Shared authentication

2.6. Soft AP Function Features

Low Power WiFi Module supports Soft AP mode for user application development and testing of their product. The AP features includes:

802.11 b/g/n AP mode
Customized SoftAP setting, include
- Channel
- Beacon interval
- Regulatory
- Country code setting
- Inactivity time
- Security settings
- IP settings

But, HP-LPA's Soft AP feature also has following constraints:

The number of STAs that can connect is limited to 1
DTIM Value limit id fixed to 1
No support for 802.11n aggregation
No DHCP server support
Security is limited to WPA2-PSK/AES and open only

2.7. Network Protocal

Low Power WiFi Module includes a fully IPv4 and IPv6 capable stack supporting TCP and UDP connection.Following table shows the key features of the Low Power WiFi Module IP stack, which including support for DHCP, multicast, and ARP.

The Frame size limits are (including IP headers):

Tranmit
- TCP/UDP/ICMP (v4): 1576
- ICMP (v6): 1576

UCP/UDP (v6): 1220

Receive

TCP/UDP (v4): 1516

TCP/UDP (v6): 1496

ICMPv4 and ICMPv6: 5000

Table 5 Low Power WiFi Module IP Stack Features

Feature	Support
ARP	Supported
Forwarding	Supported
Fragmentation/Reassembly	Planned
IPv4/v6 Header Processing	Supported
UDP/TCP Socket Support	Supported
DHCP v4	Client Support
Neighbor Discovery	Supported
Broadcast/Multicast	Supported
Path MTU Discovery	Supported
Address Auto-Configuration	Supported
Multicast	Planned
TCP Zero Copy Feature	Supported

2.8. Wireless Throughput Performance

Performance is affected by many factors. The Low Power WiFi Module itself can deliver throughputs at experted 11n rates. However, systerm constraints due to cost and other reasons may affect the net end to end throughput. The perforamce measured for IPv4 is doing using 1400 byte packets. Performance measured for IPv6 is doning using 1400 byte packets. The result as following tables:

Table 6 Low Power WiFi Module IPv4 Throughput

IPv4 Offload	Uplink (Low Power WiFi Module AP)	Downlink (AP Low Power WiFi Module)
UDP	5.51 Mbps	6.01 Mbps
TCP	5.14 Mbps	5.96 Mbps

Table 7 Low Power WiFi Module IPv6 Throughput

IPv6 Offload	Uplink (Low Power WiFi Module AP)	Downlink (AP Low Power WiFi Module)
UDP	5.10 Mbps	5.63 Mbps
TCP	5.00 Mbps	5.62 Mbps

2.9. Power Save Scheme

Low Power WiFi Module can work at three modes based on different power save scheme:

Normal (Active/Sleep) Mode - AP Associated, WiFi ON/OFF based on internal control

Deep Sleep Mode - Non AP Associated, WiFi OFF

Standby Mode - Non AP Associated, WiFi Shut dwon

Normal (Active/Sleep) Mode Normal mode support two work option: One is no DTIM related (Default mode), module will monitor the interval to Active/Sleep. The other is DTIM related mode, whcih allows the module to sync up with beacons sent from the AP which contains the DTIM (Delivery Traffic Indication Message). The DTIM indicates when broadcast and multicast data will be sent on the network. This property is configured on the AP (Default value is 1, which means DTIM= 100ms) and is typically configured as the number of beacons between each beacon with DTIM.

Deep Sleep/Standby Mode allows the WiFi circuitry to be “OFF” status or powered down, which results in the lower/lowest sleep current, but at the expense of longer wake up times. This is due to the module associating with the access point every time when it wakes up. The intent of this option is to allow for longer sleep times.

Following typical measurement parameters can be used for select suitable power save scheme based on the real application case:

Table 8 Power Consumption with Different Power Save Mode

WiFi Mode	Condition	Average Current	Peak Current
Standby	WiFi Shutdown	20nA ~0.9uA	< 1uA
Deep Sleep	WiFi OFF	~2uA	< 10uA
Normal (Active/Sleep)	WiFi ON - AP Connected DTIM = 100ms	~ 5mA	< 220mA
Normal (Active/Sleep)	WiFi ON – AP Connected DTIM = 500ms	~ 1mA	< 220mA
Normal (Active/Sleep)	WiFi ON – AP Connected DTIM = 1000ms	~ 0.5mA	< 220mA

In addition, for deep sleep/standby mode, module provides three wakes up options, user can select one or whole as the module wake up option. Refer to AT Instruction (Power Management Instruction Set) for more detailed setting.

Pin Wake Up

UART Wake Up

Timeout Wake Up

Pin Wake Up Option allows an external microcontroller to determine when Low Power WiFi Module should sleep and when it should wake by controlling the “Sleep_RQ” and “Sleep_ON” pin. at the deep sleep/standby mode, user can de-assert this pin low “0”, after 1’s assert to high ”1” to put the module to wake up the module. If user doesn't use pin sleep function, can leave this pin open.

UART Wake Up Option. Low Power WiFi Module can use AT command to put module into normal/sleep mode. When module works at deep sleep or standby mode, user can use ”AT+MSLP =normal” to wake up module. Refer to 4.2.2.23 for more detail.

Timeout Wake Up Option allows the sleep timeout period to be configured through the use of AT Instruction.In this option, the module will exit sleep based on the <Timeout> AT Instruction parameters. For control battery usage, user can increase <Timeout> period. It is user’s responsibility to configure < Timeout > as needed every time. User can set <Timeout> parameter cyclic or every time for each cycle, which provide much flexibility for control and synchronous in each side.

Following typical wake up parameters based on different conditions can be used for select suitable sleep scheme based on the real application case.

Table 9 Usage Activity Wake up Time

Condition	Typical Wake up Time
From “OFF” until ready to transmit when STA loses connection on wakeup (And re-associating to the same AP on the same channel)	190ms
From “OFF” until ready to transmit when STA loses connection on wakeup (And a complete rescan is required)	500ms

2.10. Parameters Configuration

Low Power WiFi Module supports AT+instruction set configuration parameters:
AT+instruction set configuration means user configure parameters through serial interface command. Refer to “AT+instruction set” chapter for more detail.

2.11. Firmware Update

Low Power WiFi Module supports firmware update though UART0 interface.
To enter the firmware update mode, Pin UD (pin 13) must be pulled high and then the module must be reset. If Pin UD is low (Low Power WiFi Module has internal pull-down for this pin. Leaving this pin unconnected is low), the module will check the firmware in the flash. If contains a valid firmware, the module will continue to run the firmware. If there is not a valid firmware present, module will sleep to conserve power, while periodically checking the pin UD.

The firmware update though UART0 interface now.The UART0 use 1 stop bit, no parity and 8 data bits. To enable a wide variety of different terminals Low Power WiFi Module uses autobaud. The autobaud functionality sense the baudrate used by the terminal program and adjusts accordingly.This is done by sending one capital 'U' to the module. The module senses the timing between bits and adjusts its own prescaler to match the sensed baudrate. The module works with baudrates in the range from 57600 to 460800 for firmware update usage.

Note: Always confirm with Manufacturer technical support before any firmware update operation. Or it may damage the module permanently.

2.12. GPIO Function

Low Power WiFi Module can provide maximum 11 GPIO pins, Refer to “1.2.1 Pin Definition” charter, which include 2 Low Power UART pins, 2 I2C interface pins, 2 Pin sleep control pins, 2 Link status pin, 1 reloafd functional pin, 1 PWM control pin and 1 general GPIO pin. All these pins can be customized as GPIO pins if these functions are not required. As GPIO functional pin, user devices can read/write GPIO pins status through AT+instruction set.

Table 10 Low Power WiFi Module GPIO Pin Mapping Table

GPIO	Configured Function	Describtion	Default Setting	Type
GPIO3	WPS	WiFi Protected Setup	WPS	I,IPU
GPIO4	UART1 Data Receive	Low Energy UART (Optional)	GPIO4	I/O
GPIO5	UART1 Data Transmit		GPIO5	I/O
GPIO20	Sleep_RQ	Pin Sleep Control	Sleep_RQ	I, IPD
GPIO8	Sleep_ON		Sleep_ON	O,OPD
GPIO9	I2C_SDA	I2C EEPROM interface	I2C_SDA	I/O, IPU
GPIO10	I2C_SCL		I2C_SCL	O, IPU
GPIO11	nLINK	WiFi Link status	“nLINK”	O,IPU
GPIO12	nReload	nReload function	“nReload”	I,IPU
GPIO7	nReady	nReady function	“nReady”	O,IPU
GPIO21	GPIO21	GPIO function	GPIO21	I/O

3. OPERATION GUIDELINE

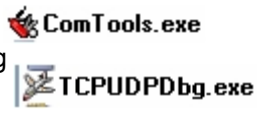
3.1. Low Power WiFi Module Usage Introduction

3.1.1. Software Debug Tools

Manufacturer use two common software tools debugging and applying Low Power WiFi Module. (User can also select other tools used to debug serial port).

Serial Debugging Software: ComTools

Ethernet Debugging Software: TCPUDPDbg



3.1.2. Network Connection

User can use folloing method to connect Low Power WiFi Module base on dedicated application. Low Power WiFi Module and debug PC2 connect to a wireless AP, another PC1 (or user device) connect to Low Power WiFi Module with serial port:

Figure 8. STA Interface Debug Connection

3.1.3. Module Debug

PC1 open “CommTools” program, setting the same serial port parameters with Low Power WiFi Module and open serial port connection.

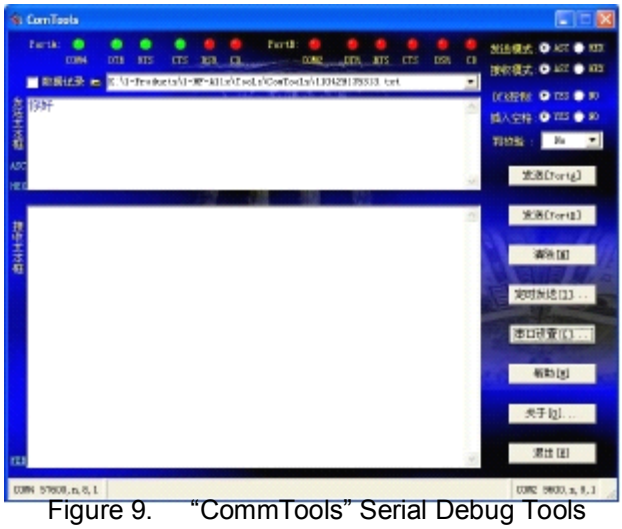


Figure 9. “CommTools” Serial Debug Tools

PC2 open “TCPUDPDbg” program, and create a new connection. If Low Power WiFi Module configured as Server mode, “TCPUDPDbg” Tools shall create “Client “mode connection. Or otherwise, create a “Server” mode connection.

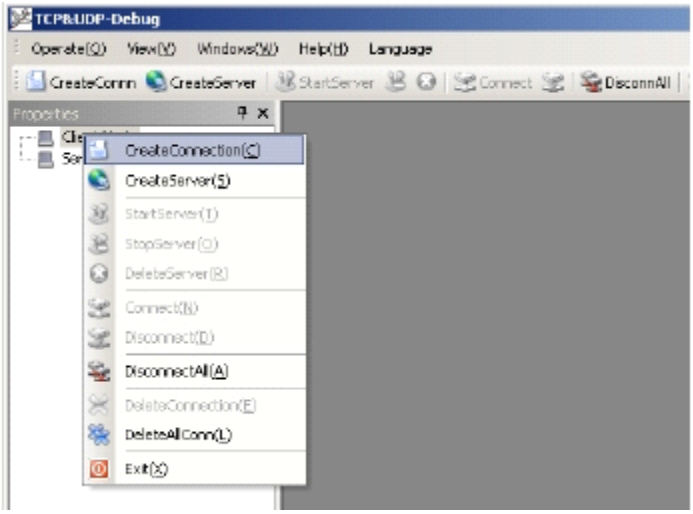


Figure 10. “TCPUDPDbg” Tools Create Connection

Then setting the TCP/UDP connection parameters. Default as following:

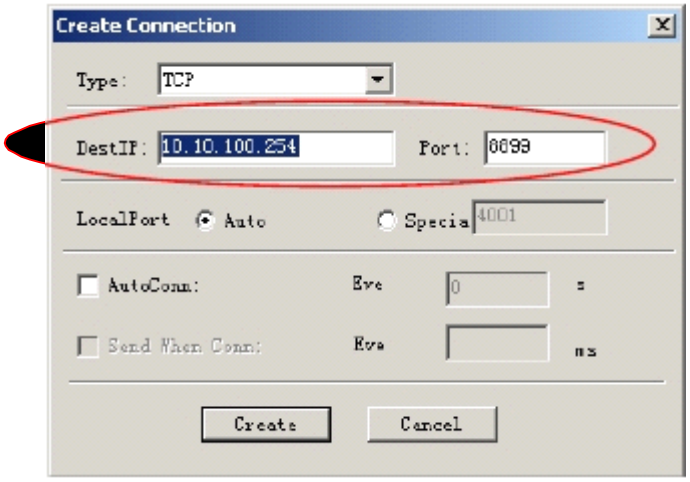


Figure 11. “TCPUDPDbg” Tools Setting

Then, click “Create” button to create a connection.

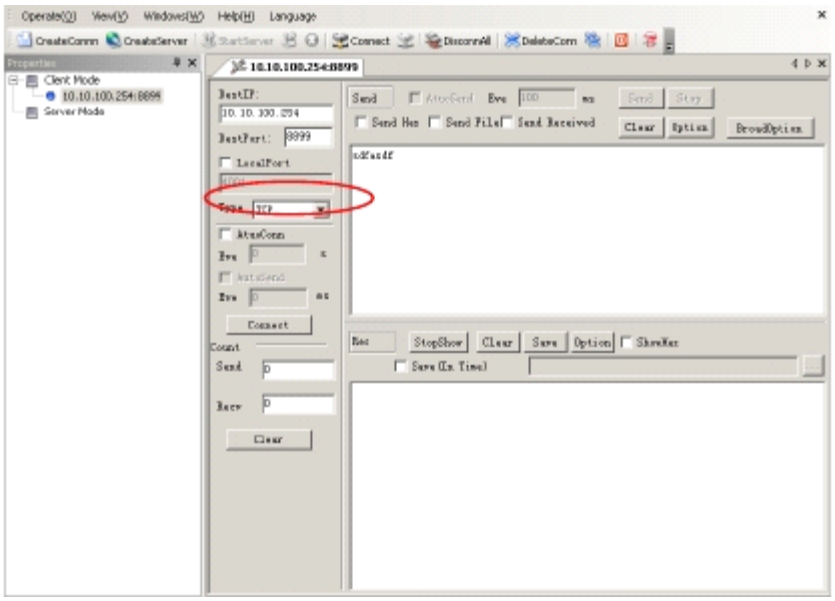


Figure 12.

“TCPUDPDbg” Tools Connection

Now, in transparent transmission mode, data can be transferred from “CommTools” program to “TCPUDPDbg” program, or in reverse. You can see data in receiver side will keep same as in sender side.

3.2. Typical Application Examples

3.2.1. Wireless Control Application

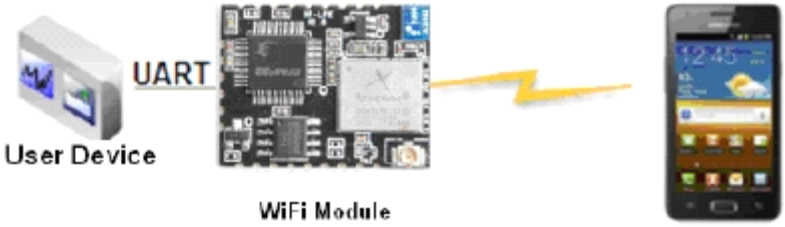


Figure 13. Wireless Control Application

For this wireless control application, Low Power WiFi Module works as Ad-Hoc mode. Module’s serial port connects to user device. So, control agent (Smart phone for this example) can manage and control the user device through the wireless connection with Low Power WiFi Module.

3.2.2. Remote Management Application

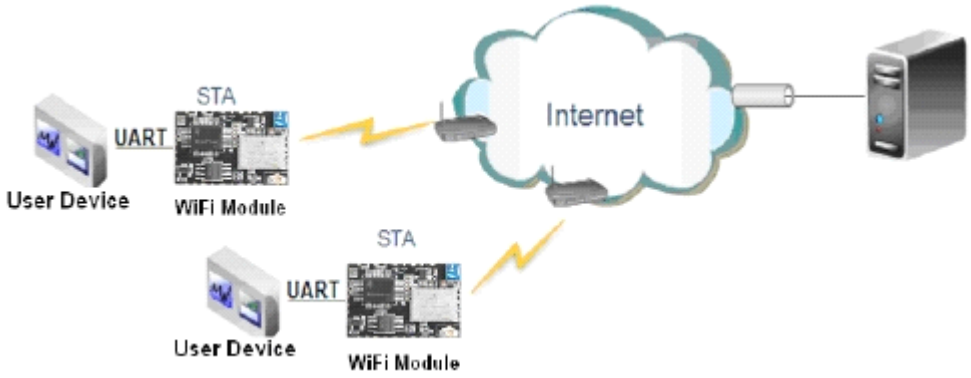


Figure 14. Remote Management Application

For this remote management application, Low Power WiFi Module works as STA mode and connects to Internet through wireless AP. Module configured as TCP Client and communicates with remote TCP server at Internet. Module's serial port connects to user device.

So, user device's data or sampling information can send to remote TCP server for storage or processing. Also remote TCP server can send command to control and manage the user device through the wireless network.

3.2.3. Transparent Serial Port Application

For this transparent serial port application, two Low Power WiFi Modules connect as below figures to build up a transparent serial port connection. Low Power WiFi Module works as Ad-Hoc mode to connect each other.

Figure 15. Transparent Serial Port Application

4. AT+INSTRUCTION INTRODUCTION

4.1. Configuration Mode

When Low Power WiFi Module power up, it will default works as transparent transmission mode, then user can switch to configuration mode by serial port command. Low Power WiFi Module UART default parameters setting as below figure,

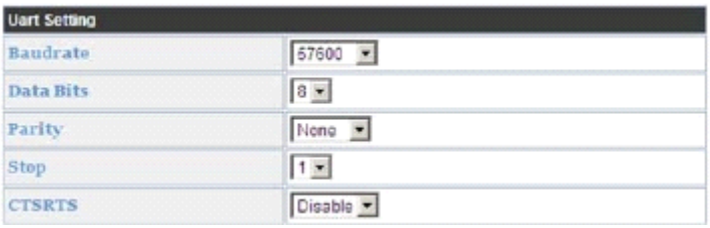


Figure 16. Low Power WiFi Module Default UART Port Parameters

In configuration mode, user can setting the module through AT+ instruction set, which cover all web page setting function.

4.1.1. Switch to Configuration Mode

Two steps to finish switching from transparent transmission mode to configuration mode.

UART input "+++", after module receive "+++", and feedback "a" as confirmation.
UART input "a", after module receive "a" and feedback "+ok" to go into AT+ instruction set configuration mode.

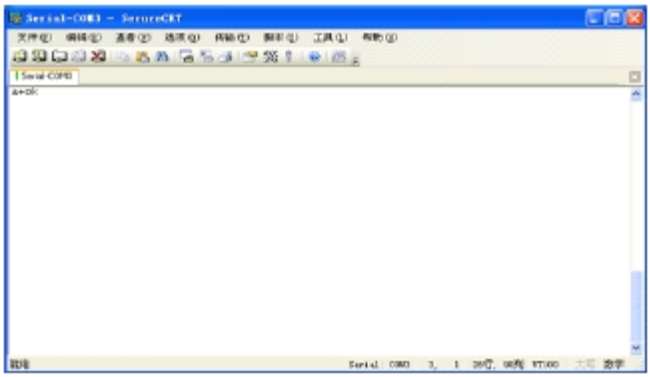


Figure 17. Switch to Configuration Mode

Notes:

1. When user input "+++" (No "Enter" key required), the UART port will display feedback information "a", and not display input information"+++" as above UART display.
2. Any other input or wrong step to UART port will cause the module still works as original mode (transparent transmission).

4.2. AT+ Instruction Set Overview

User can input AT+ Instruction through hyper terminal or other serial debug terminal, also can program the AT+ Instruction to script. User can also input “AT+H” to list all AT+ Instruction and description to start.

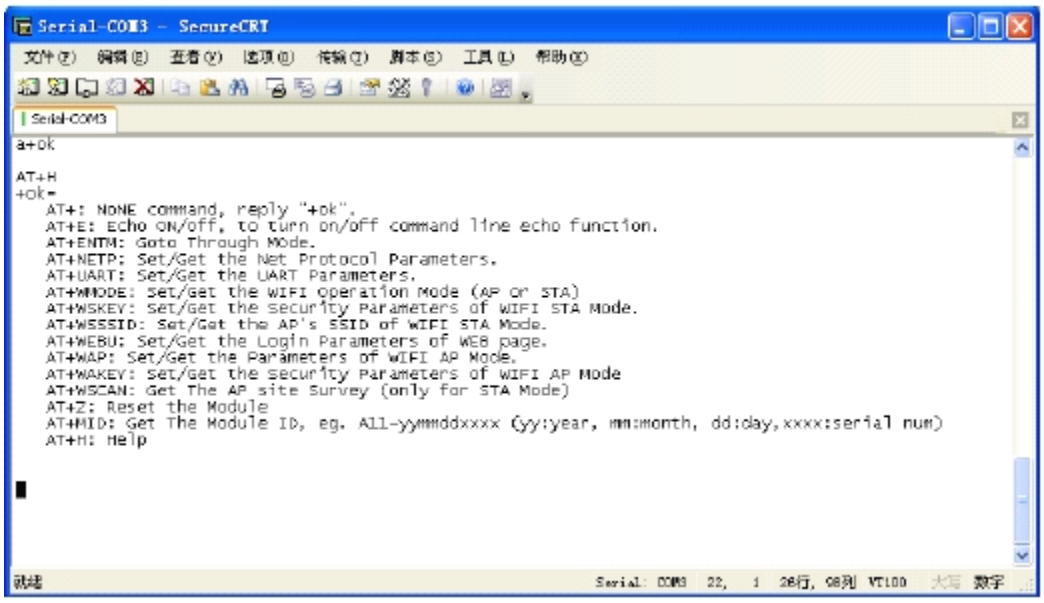

Serial-COM3 - SecureCRT
Serial-COM3
a+ok
AT+H
+ok=
AT+: NONE command, reply "+ok".
AT+E: Echo ON/off, to turn on/off command line echo function.
AT+ENTM: Goto Through Mode.
AT+NETP: Set/Get the Net Protocol Parameters.
AT+UART: Set/Get the UART Parameters.
AT+WMODE: Set/Get the WIFI operation Mode (AP or STA)
AT+WSKEY: Set/Get the security Parameters of WIFI STA Mode.
AT+WSSSID: Set/Get the AP's SSID of WIFI STA Mode.
AT+WEBU: Set/Get the Login Parameters of WEB page.
AT+WAP: Set/Get the Parameters of WIFI AP Mode.
AT+WAKEY: Set/Get the security Parameters of WIFI AP Mode
AT+WSCAN: Get The AP site Survey (only for STA Mode)
AT+Z: Reset the Module
AT+MID: Get The Module ID, eg. All-yymmddxxxx (yy:year, mm:month, dd:day,xxxx:serial num)
AT+H: Help

Figure 18. ”AT+H” Instruction for Help

4.2.1. Instruction Syntax Format

AT+Instruction protocol is based on the instruction of ASCII command style, the description of syntax format as follow.

Format Description

< >: Means the parts must be included

[ ]: Means the optional part

Command Message

AT+<CMD>[op][para-1,para-2,para-3,para-4…]<CR>

AT+: Prefix of command message;

CMD: Command string;

[op]: Symbol of command operator,

“=” : The command requires parameters input;

“NULL”: Query the current command parameters setting;

[para-n]: Parameters input for setting if required;

<CR>：”Enter” Key, it’s 0x0a or 0x0d in ASCII;

Notes: When input AT+Instruction, “AT+<CMD>” character will display capital letter automatic and other parts will not change as you input.

Response Message

+<RSP>[op] [para-1,para-2,para-3,para-4…]<CR><LF><CR><LF>

+: Prefix of response message;
RSP: Response string;
"ok" : Success
"ERR": Failure
[op] : =
[para-n]: Parameters if query command or Error code when error happened;
<CR>: ASCII 0x0d;
<LF>: ASCIII 0x0a;

Error Code

Table 11 Error Code Describtion

Error Code	Description
-1	Invalid Command Format
-2	Invalid Command
-3	Invalid Operation Symbol
-4	Invalid Parameter
-5	Operation Not Permitted

4.2.2. AT+ Instruction Set

Table 12 AT+ Instruction Set List

Instruction	Description
<null>	NULL
Managment Instruction Set	
E	Open/Close show back function
WMODE	Set/Query WIFI work mode (ADHOC or STA)
ENTM	Set module into transparent transmition mode
MID	Query module ID information
VER	Query module software version information
RELD	Restore to factory default setting
Z	Re-start module
H	Help
UART Instruction Set	
UART	Set/Query serial port parameters
UARTF	Open/Close UART auto-frame function
UARTFT	Set/Query UART auto-frame trigger time
UARTFL	Set/Query UART auto-frame trigger length
UARTTE	Set/Query UART free-frame triggerf time between two bytes
Network Instruction Set	
NETP	Set/Query network protocol parameters
TCPLK	Query if TCP link already build-up

TCPTO	Set/Query TCP timeout
WiFi STA Instruction Set	
WSKEY	Set/Query WIFI security parameters as STA
WSSSID	Set/Query WIFI target AP SSID parameters as STA
WANN	Set/Query WAN setting, only effective as STA mode
WSLK	Query WiFi link status as STA
WSLQ	Query WiFi signal strength as STA
WSCAN	Seek AP when module works as STA mode
LANN	Set/Query LAN setting,only effective as ADHOC mode
Power Management Instruction Set	
PSPAR	Set/Query power save parameters at NORMAL mode
MSOPT	Set/Query wake up option parameters
MSLP	Set/Query deep sleep/standby mode parameters
TSPAR	Set/Query timeout wake up parameters
Others Instruction Set	
WMAC	Query WiFi interface MAC address
WRMID	Set module ID
ASWD	Set/Query WiFi configuration code

4.2.2.1. AT+E

Function: Open/Close show back function;

Format:

AT+E<CR>

+ok<CR>< LF ><CR>< LF >

When Low Power WiFi Module firstly switch from transparent transmission to configuration mode, show back status is open, input “AT+E” to close show back function, input“AT+E” again to open show back function.

4.2.2.2. AT+WMODE

Function: Set/Query WIFI work mode;

Format:

Query Operation

AT+WMODE<CR>

+ok=<mode><CR>< LF ><CR>< LF >

Set Operation

AT+ WMODE=<mode><CR>

+ok<CR>< LF ><CR>< LF >

Parameters:

mode:WIFI work mode

ADHOC

STA

4.2.2.3. AT+ENTM

Function: Set module into transparent transmition mode;

Format:

AT+ENTM<CR>
+ok<CR>< LF ><CR>< LF >

When operate this command, module switch from configuration mode to transparent transmission mode.

4.2.2.4. AT+MID

Function: Query module ID information;

Format:

Query Operation

AT+MID<CR>
+ok=<module_id><CR>< LF ><CR>< LF >

Parameters:

module_id: Module ID information;

Low Power WiFi Module;

Notes: User can set this parameter through AT+WRMID.

4.2.2.5. AT+VER

Function: Query module software version information;

Format:

Query Operation

AT+VER<CR>
+ok=<ver><CR>< LF ><CR>< LF >

Parameters:

ver: Module software version information;

4.2.2.6. AT+RELD

Function: module restore to factory default setting;

Format:

Set Operation

AT+ RELD<CR>
+ok=rebooting...<CR>< LF ><CR>< LF >

When operate this command, module will restore to factory default setting and reboot.

4.2.2.7. AT+Z

Function: Re-start module;

Format:

AT+ Z<CR>

4.2.2.8. AT+H

Function: Help;

Format:

Query Operation

AT+H<CR>
+ok=<commod help><CR>< LF ><CR>< LF >

Parameters:

commod help: command introduction;

4.2.2.9. AT+UART

Function: Set/Query serial port parameters;

Format:

Query Operation

AT+UART<CR>

+ok=<baudrate,data_bits,stop_bit,parity><CR>< LF ><CR>< LF >

Set Operation

AT+UART=<baudrate,data_bits,stop_bit,parity><CR>

+ok<CR>< LF ><CR>< LF >

Parameters:

baudrate:

300,600,1200,1800,2400,4800,9600,19200,38400,57600,115200,230400,380400

data_bits:

8

stop_bits:

1,2

parity:

NONE,EVEN,ODD

4.2.2.10. AT+ UARTF

Function: Open/Close UART auto-frame function;

Format:

Query Operation

AT+ UARTF<CR>

+ok=<para><CR>< LF ><CR>< LF >

Set Operation

AT+ UARTF=<para ><CR>

+ok<CR>< LF ><CR>< LF >

Parameters:

para:

disable - Close auto-frame function;

enable - Open auto-frame function;

4.2.2.11. AT+ UARTFT

Function: Set/Query UART auto-frame trigger time;

Format:

Query Operation

AT+ UARTFT<CR>

+ok=<time><CR>< LF ><CR>< LF >

Set Operation

AT+ UARTFT=<time ><CR>

+ok<CR>< LF ><CR>< LF >

Parameters:

time: Range 100 ~10000; Unit: ms. Auto-frame trigger time

4.2.2.12. AT+ UARTFL

Function: Set/Query UART auto-frame trigger length;

Format:

Query Operation

AT+ UARTFL<CR>

+ok=<len><CR>< LF ><CR>< LF >

Set Operation

AT+ UARTFL=<len ><CR>

+ok<CR>< LF ><CR>< LF >

Parameters:

len: Range 16 ~1400; Unit: Byte. Auto-frame trigger length;

4.2.2.13. AT+ UARTTE

Function: Set/Query UART free-frame trigger time between two bytes;

Format:

Query Operation

AT+ UARTTE<CR>

+ok=<mode><CR>< LF ><CR>< LF >

Set Operation

AT+ UARTTE=<mode><CR>

+ok<CR>< LF ><CR>< LF >

Parameters:

mode:

fast: free-frame trigger time between two bytes is 10ms;

normal: free-frame trigger time between two bytes is 50ms;

4.2.2.14. AT+NETP

Function: Set/Query network protocol parameters;

Format:

Query Operation

AT+NETP<CR>

+ok=<protocol,CS,port,IP><CR>< LF ><CR>< LF >

Set Operation

AT+NETP=<protocol,CS,port,IP><CR>

+ok<CR>< LF ><CR>< LF >

Parameters:

protocol:

TCP

UDP

CS: Network mode:

SERVER

CLIENT

Port: protocol port ID: Decimal digit and less than 65535

IP: Server's IP address when module set as client

4.2.2.15. AT+ TCPLK

Function: Query if TCP link already build-up;

Format:

AT+ TCPLK<CR>

+ok=<sta><CR>< LF ><CR>< LF >

Parameters:

sta.: if module already setup TCP link;

on: TCP link setup;

off: TCP link not setup;

4.2.2.16. AT+ TCPTO

Function: Set/Query TCP timeout;

Format:

Query Operation

AT+ TCPTO<CR>

+ok=<time><CR>< LF ><CR>< LF >

Set Operation

AT+ TCPTO=<time ><CR>

+ok<CR>< LF ><CR>< LF >

Parameters:

time: TCP timeout time.

<= 600, (600s);

>=0, (0 means no timeout);

Default, 300s;

4.2.2.17. AT+WSSSID

Function: Set/Query WIFI target AP SSID parameters as STA.

Format:

Query Operation

AT+WSSSID<CR>

+ok=<ap's ssid><CR>< LF ><CR>< LF >

Set Operation

AT+ WSSSID=<ap's ssid ><CR>

+ok<CR>< LF ><CR>< LF >

Parameters:

ap's ssid: AP's SSID (Within 20 character);

4.2.2.18. AT+WSKEY

Function: Set/Query WIFI security parameters as STA;

Format:

Query Operation

AT+WSKEY<CR>

+ok=<auth,encry,key><CR>< LF ><CR>< LF >

Set Operation

AT+ WSKEY=< auth,encry,key><CR>

+ok<CR>< LF ><CR>< LF >

Parameters:

auth: Authentication mode

OPEN

SHARED

WPAPSK

WPA2PSK

encry:Encryption algorithm

NONE: When “auth=OPEN”, effective

WEP: When “auth=OPEN” or “SHARED”, effective

TKIP: When ”auth= WPAPSK” or “WPA2PSK”, effective

AES: When “auth= WPAPSK” “WPA2PSK”, effective

key: password, ASCII code, shall less than 64 bit and greater than 8bit

4.2.2.19. AT+ WANN

Function: Set/Query WAN setting, only effective as STA mode;

Format:

Query Operation

AT+WANN<CR>

+ok=<mode,address,mask,gateway><CR>< LF ><CR>< LF >

Set Operation

AT+ WANN=< mode,address,mask,gateway ><CR>

+ok<CR>< LF ><CR>< LF >

Parameters:

mode: IP setting for WAN port

static: Static IP

DHCP: Dynamic IP

address: WAN port IP address;

mask: WAN port subnet mask;

gateway: WAN port gateway address;

4.2.2.20. AT+ LANN

Function: Set/Query the IP address under ADHOC mode;

Format:

Query Operation

AT+LANN<CR>

+ok=<ipaddress,mask><CR>< LF ><CR>< LF >

Set Operation

AT+ LANN=< ipaddress,mask><CR>

+ok<CR>< LF ><CR>< LF >

Parameters:

ipaddress: IP address under ADHOC mode;

mask: Net mask under ADHOC mode;

4.2.2.21. AT+ WSLK

Function: Query WiFi link status as STA

Format:

Query Operation

AT+ WSLK<CR>

+ok=<ret><CR>< LF ><CR>< LF >

Parameters:

ret

”Disconnected”, if no WiFi connection;

”AP’ SSID（AP’s MAC”）, if WiFi connection available;

”RF Off”, if WiFi OFF;

4.2.2.22. AT+ WSLQ

Function: Query WiFi signal strength as STA

Format:

Query Operation

AT+ WSLQ<CR>

+ok=<ret><CR>< LF ><CR>< LF >

Parameters:

ret

”Disconnected”, if no WiFi connection;

”AP’s WiFi signal strength” , if WiFi connection available;

4.2.2.23. AT+WSCAN

Function: Seek AP when module works as STA mode;

Format:

AT+ WSCAN<CR>

+ok=<ap_site><CR>< LF ><CR>< LF >

Parameters:

ap_site: AP searched;

4.2.2.24. AT+PSPAR

Function: Set/ Query power save parameters at Normal mode;

Format:

Query Operation

AT+ PSPAR<CR>

+ok=<mode> <CR>< LF ><CR>< LF >

Set Operation

AT+ PSPAR=<mode> <CR>< LF ><CR>< LF >

Parameters:

mode:

pf：Continuous TX Mode (NO WiFi OFF)

ps1：Normal Mode, Disable DTIM (**Default, 100ms interval**)

ps2：Normal Mode, Enable DTIM

4.2.2.25. AT+MSLP

Function: Set/Query deep sleep/standby mode parameters;

Format:

Query Operation

AT+ MSLP<CR>

+ok=<ret><CR>< LF ><CR>< LF >

Set Operation

AT+ MSLP=<mode><CR>< LF ><CR>< LF >

Parameters:

ret:

normal: normal mode (ps1: 100ms interval)

deep sleep: deep sleep mode [WiFi OFF]

standby: WiFi shut down mode

mode:

normal: normal mode (ps1: 100ms interval)

dslp: deep sleep mode [WiFi OFF]

standby: WiFi shut down mode

4.2.2.26. AT+MSOPT

Function: Set/Query wake up option parameters;

Format:

Query Operation

AT+ MSOPT<CR>

+ok=<wakeup_mode> <CR>< LF ><CR>< LF >

Set Operation

AT+ MSOPT=<wakeup_mode> <CR>< LF ><CR>< LF >

Parameters:

Wakeup_mode:

0b0001：UART Wake up

0b0010：Pin Wake up

0b0100：Timeout Wake up

Note: These 3 options can multi-selection, such as 0b0111 means all three wakes up option enabled.

4.2.2.27. AT+TSPAR

Function: Set/Query timeout wake up parameters;

Format:

Query Operation

AT+ TSPAR<CR>

+ok=<timeout> <CR>< LF ><CR>< LF >

Set Operation

AT+ TSPAR=<timeout> <CR>< LF ><CR>< LF >

Parameters:

timeout: set timeout time, unit: second.

4.2.2.28. AT+WMAC

Function: Query WiFi interface MAC address;

Format:

Query Operation

AT+ WMAC<CR>

+ok=<wmac> <CR>< LF ><CR>< LF >

Parameters:

wmac: query WiFi interface MAC address.

4.2.2.29. AT+WRMID

Function: Set module ID;

Format:

Set Operation

AT+ WRMID=<wrmid> <CR>< LF ><CR>< LF >

Parameters:

wrmid: set module's ID (within 20 characters).

4.2.2.30. AT+ASWD

Function: Set/Query WiFi Configuration Password;

Format:

Query Operation

AT+ ASWD<CR>

+ok=<aswd> <CR>< LF ><CR>< LF >

Set Operation

AT+ ASWD=<aswd> <CR>< LF ><CR>< LF >

Parameters:

aswd: WiFi Configuration Password (within 20 characters).

5. PACKAGE INFORMATION

5.1. Recommended Reflow Profile

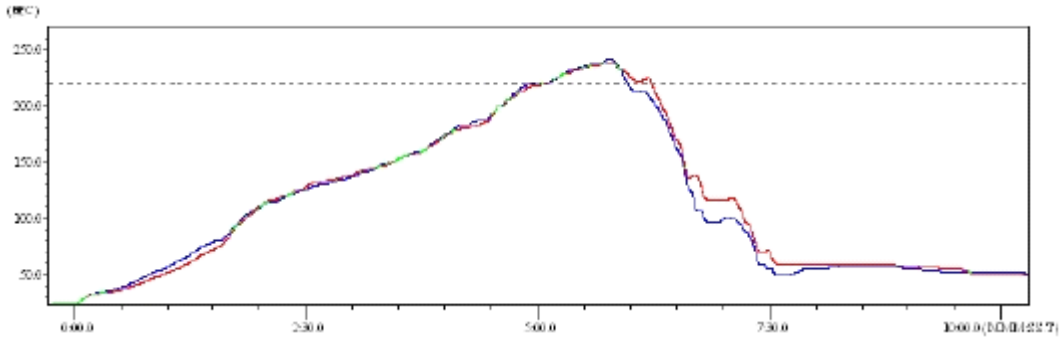


Figure 19. Reflow Soldering Profile

NO.	Item	Temperature (Degree)	Time(Sec)
1	Reflow Time	Time of above 220	35~55 sec
2	Peak-Temp	260 max	

Note: 1. Recommend to supply N2 for reflow oven.

2. N2 atmosphere during reflow (O2<300ppm)

5.2. Device Handling Instruction (Module IC SMT Preparation)

Shelf life in sealed bag: 12 months, at <30℃ and <60% relative humidity (RH)

After bag is opened, devices that will be re-baked required after last baked with window time 168 hours.

Recommend to oven bake with N2 supplied

Recommend end to reflow oven with N2 supplied

Baked required with 24 hours at 125+-5℃ before rework process for two modules, one is new module and two is board with module

Recommend to store at ≦10% RH with vacuum packing

If SMT process needs twice reflow:

(1) Top side SMT and reflow (2) Bottom side SMT and reflow

Case 1: Wifi module mounted on top side. Need to bake when bottom side process over 168 hours window time, no need to bake within 168 hours

Case 2: Wifi module mounted on bottom side, follow normal bake rule before process

Note: Window time means from last bake end to next reflow start that has 168 hours space.

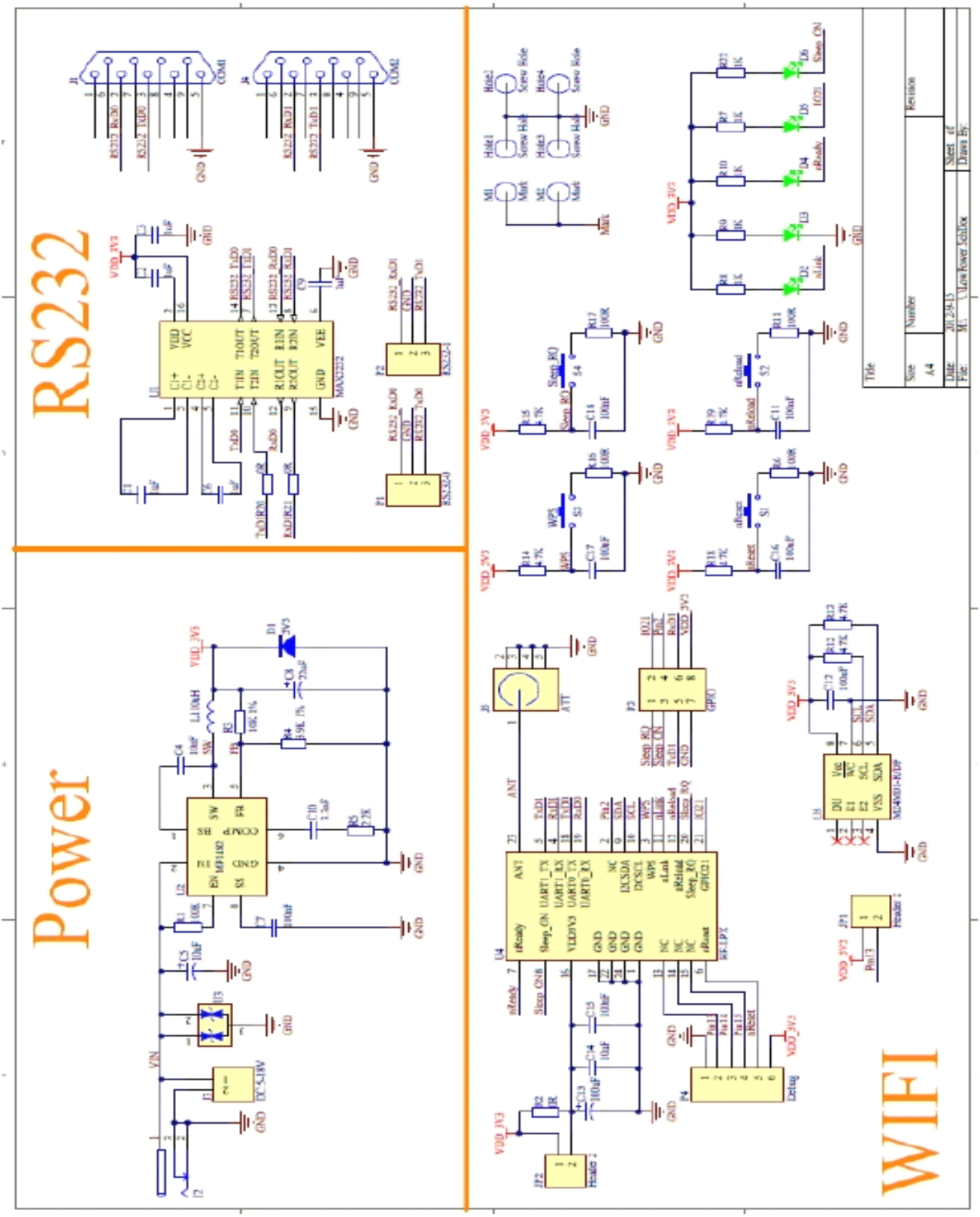
5.3. Shipping Information

Figure 20. Shipping Information

Note: 1 tray = 168pcs

1 box = 10 trays = 10 * 168pcs=1,680pcs

APPENDIX A: HW REFERENCE DESIGN



6. Contact us

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